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Comparison of the effects of dry needling technique and combination of different manual therapy techniques on electrophysiological and psychological status in patients with myofascial pain syndrome - randomized, controlled, single blind, a pilot study

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ABSTRACT

Aims: Our aim was to compare the electrophysiological and psychometric properties of the effects of the dry needling technique, graston technique, and muscle energy technique in treating myofascial pain syndrome.

Methods: The study included 21 patients diagnosed with myofascial pain syndrome (MPS) and an active trigger point in the upper trapezius muscle. The patients were randomly divided into three groups of 7 each. The first group received only exercise and dry needling technique (DNT), the second group received graston technique (GT), muscle energy technique (MET) and exercise, and the third group received only exercise. Evaluations were conducted before and after treatment. The trigger point detected with an algometer in the upper trapezius muscle was evaluated with needle electromyography (EMG). The study used the Beck Depression Inventory (BDI) to determine its effects on psychological state.

Results: The change in EMG variable over time was significant in each treatment group ($p<0.05$). The improvement in EMG change was more pronounced in the DNT group compared to the other groups. There was also a significant decrease in BDI scores before and after treatment ($p<0.05$). Pairwise comparison analysis revealed an improvement in the BDI scores of all groups, except the control (exercise) group, after treatment, when compared to pre-treatment.

Conclusion: During the trigger point needle EMG examination of all subjects in the study, we detected spontaneous muscle activity (SMA) in addition to entry activity. After treatment, we observed improvement in SMA. These results suggest that the applied techniques are effective in treating trigger points.The effectiveness of the applied techniques can be evaluated in terms of creating alternatives.

Keywords: Dry needling, manual therapy, graston technique, muscle energy technique, myofascial pain syndrome

INTRODUCTION

Myofascial pain syndrome (MPS) is a non-inflammatory syndrome that affects a specific area of the body, characterized by taut bands on skeletal muscle fibers and fascia. It is very common among musculoskeletal system problems. Pain and muscle spasm develop due to myofascial trigger points (MTP) on taut bands. Movement restriction may occur in the joints related to MTP and regional autonomic symptoms may be seen.[1,2] MTPs are palpable and may produce tense, aching, tender, and referred pain on palpation. Passive MTPs do not produce referred pain. They can become active through physical activity or coercion.[3] MTPs can be found in many different muscle groups.It is frequently seen in the postural muscles and upper trapezius muscle and the muscles surrounding the pelvis.[4,5]

Although methods such as sonoelastography, thermography, doppler imaging, magnetic resonance elastography have been used in diagnostic imaging in recent years, there is no technique that specifically defines MTPs radiologically.[6-9]

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Electrophysiologically, changes such as spontaneous increase in electrical activity and delayed relaxation have been shown in MTPs.[10,11] Methods such as biochemical laboratory tests are not imaging, pressure algometer value and EMG continue to be investigated to obtain information about MTPs.[6,10,11] Many invasive and non-invasive treatment methods are used for trigger points in MPS. Dry needling technique (DNT) is an invasive and effective method.It is applied directly on tension bands and MTPs with acupuncture needles of various sizes.[12] Graston technique (GT) and muscle energy technique (MET) are noninvasive manual therapy techniques.[13,14] It is applied with tools made of stainless steel in various sizes designed according to the areas where GT is applied.The purpose of GT is to support healing with microtrauma in soft tissue and to increase tissue elasticity.[13] MET was developed by osteopaths.[14] The practice includes movements that require the active participation of the patient.[15] These movements primarily target the soft tissue and increase the range of motion of the joint. Also known as active muscle relaxation technique.[14,16]

The aim of this study is to compare the electrophysiological and psychometric properties of the effects of dry needling technique and graston and muscle energy techniques in the treatment of myofascial pain syndrome.

METHODS

Ethical Process

The study was carried out with the permission of Ankara Medicana International Hospital Ethics Committee (Date: 29.03.2021, Decision No: 12). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Partcipants

The study included 21 patients who applied to Medicana International Ankara Hospital Physical Therapy and Rehabilitation Polyclinic between August 2021 and June 2022, diagnosed and signed the consent form. The diagnosis of MPS was made based on the diagnostic criteria described by Travell and Simons.[17] Patients with neck and/or shoulder and/or back pain who had at least one active trigger point detected by algometry and palpation in the upper trapezius muscle were included in the study. Those with cervical radiculopathy, cancer, fracture, inflammatory disease diagnosis and surgery history in the last 6 months, and those who were under pregnancy follow-up were not included in the study.

Study Desing and Randomization

Participants were randomly(By cart selection) divided into 3 groups and the patients in the first group were given exercise+DNT, the patients in the second group exercise+MET+GT, and the patients in the third group only exercised. The treatments were applied as 3 sessions in two weeks. The exercises were given as a home program (Three times for every day). Depression level before and after the treatment was evaluated with Beck Depression Inventory (BDI) and electrophysiological activity of detected MTPs with needle electromyography (EMG). BDI is a questionnaire that expresses the level of depression, consists of 21 questions in total and has 4 items in each question (scored between 0 and 3 points). High scores indicate the severity of depression.[18] The patients filled the scale, which was organized in the form of a questionnaire, under the supervision of a physiotherapist by choosing the expression they felt closest to them. Needle EMG evaluations of MTPs were made by a blinded neurologist. The motor unit potential (MUP) amplitude value in the needle EMG examination we performed was recorded as a unit value in the report. In the upper trapezius muscle trigger point examination, SMA was observed except the entry activity. Measurements from the same trigger point before and after treatment were compared.

Statistical Analysis

Statistical analyzes were performed using the SPSS (IBM SPSS Statistics 23) package program. Descriptive statistics such as mean and standard deviation were given for numerical variables. Percentage values and frequency tables were given for categorical variables.Whether the numerical measurements to be taken from the patients changed over time were similar between the 3 groups, was analyzed by analysis of variance in repeated measurements. In order to determine the effects of the intervention on the measured variables, a mixed design ANOVA was applied with time (pre-treatment and post-treatment) as an within-subject factor (pre-treatment and after-treatment) and between-groups (exercise+DNT, exercise+MET+GT, exercise) as an inter-subject (group) factor. The Bonferroni test was used for pairwise (post-hoc) comparisons in case of significant factors or interactions. Statistical significance level was accepted as $p < 0.05$. In this study, the efficacy of 3 different treatment methods (including the control group) in patients diagnosed with MPS was investigated under exercise control. It was examined whether the EMG test results of the patients and the results to be obtained from BDI differ according to time and treatment type. As the primary outcome, the EMG value, which determines the pain intensity of the patients at the trigger points, was discussed.

RESULTS

The study recorded age, gender, height, weight, body mass index, smoking status, sleep problems, and average daily sleep time data of the included patients. **Table 1, 2** presents demographic characteristics of patients with MPS.

Table 1. Demographic Characteristics of the Patients Participating in the Study -1

Variable		Number	Rate
Gender	Female	16	76.2%
	Male	5	23.8%
Smoking Status	No	13	61.9%
	Yes	8	38.1%
BMI*	18.5 and under Underweight	4	19.0%
	18.5 - 24.9 Normal Weight	14	66.7%
	25-29.9 Overweight	3	14.3%
Sleeping Problem	No	15	71.4%
	Yes	6	28.6%

*Body Mass Index (BMI)

Table2. Demographic Characteristics of the Patients Participating in the Study -2

Variable	Minimum	Maximum	Average	Standard deviation
Age	21	50	31.8	10.1
Weight (kg)	52	85	66.4	8.5
Height (cm)	157	184	170.1	7.3
BMI (kg/m2)*	23	17	28.0	2.6
Sleeping time (hours)	5	10	6.9	1.2

*Body Mass Index (BMI)

The average age of the patients between the ages of 21-50 who participated in the study was 31.8 years.The sleep duration of the patients varies between 5-10 hours per day, with an average sleep duration of 6.9 hours (Table 2). The mean EMG MUP amplitude values in all treatment groups were 5.3 units before treatment and 1.9 units after treatment. In each treatment group, a decrease was observed in the mean EMG value after treatment compared to pretreatment (Figure 1).

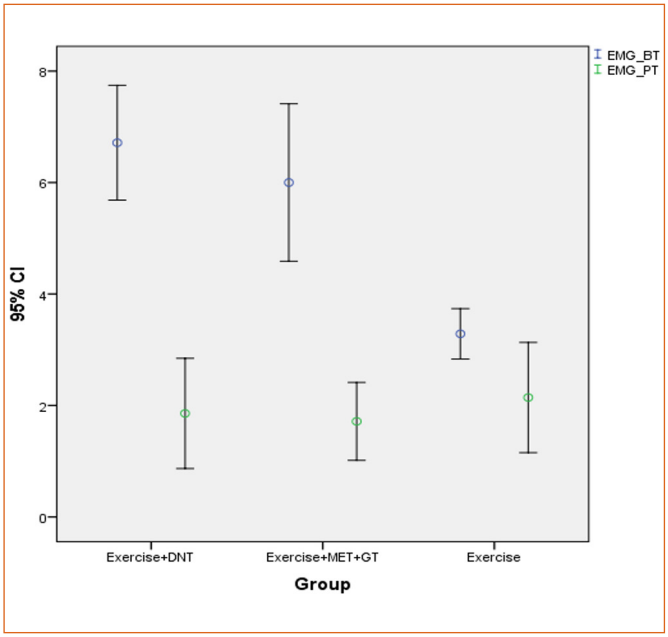

Figure 1. Exercise+Dry Needling, Exercise+Muscle Energy+Graston, and Exercise Effect on EMG (error bar graph with 95% Confidence Interval)
Electromyography Before Treatment (EMG BT)
Electromyography Post-Treatment (EMG PT)

According to the results of the ANOVA analysis in repeated measurements, the interaction effect between the groups was found to be significant for the EMG variable on a time basis ($p<0.05$). In other words, the change in EMG values over time differs according to the treatment methods (Table 3).

Table 3. Average EMG Values Before and After Treatment According to Treatment Groups

Group	Before Treatment Average±Standard Deviation	After Treatment Average±Standard Deviation	p
Exercise+DNT (n=7)	6.7±1.1	1.9±1.1	<0.05
Exercise+DNT+GT (n=7)	6.0±1.5	1.7±0.8	
Exercise (n=7)	3.3±0.5	1.9±0.9	

It was determined that a curative effect occurred before and after treatment in each treatment group evaluated with EMG values. According to the pairwise comparison analysis, improvement was detected in each group after treatment when compared with pre-treatment (Table 4). The difference between before and after treatment in all groups was statistically significant ($p<0.05$). When the pairwise comparison results are examined, it is seen that the greatest improvement in terms of EMG values is in the group treated with exercise and DNT.

While the mean BDI values were 14.1 units before the treatment in all treatment groups, it was 9.9 units after the treatment. In each treatment group, a decrease was observed in the mean BDI value compared to before (Figure 2).

Table 4. Paired Comparisons of Before and Post-Treatment EMG Values According to Treatment Groups

Group			Average Difference	Standard error	p	Confidence Interval	
						Lower Limit	Upper Limit
Exercise +DNT	BT	PT	4.8	0.46	0.00	3.88	5.83
	PT	BT	-4.8	0.46	0.00	-5.83	-3.88
Exercise +MET+GT	BT	PT	4.2	0.46	0.00	3.31	5.26
	PT	BT	-4.2	0.46	0.00	-5.26	-3.31
Exercise	BT	PT	1.1	0.46	0.02	0.17	2.12
	PT	BT	-1.1	0.46	0.02	-2.12	-0.17

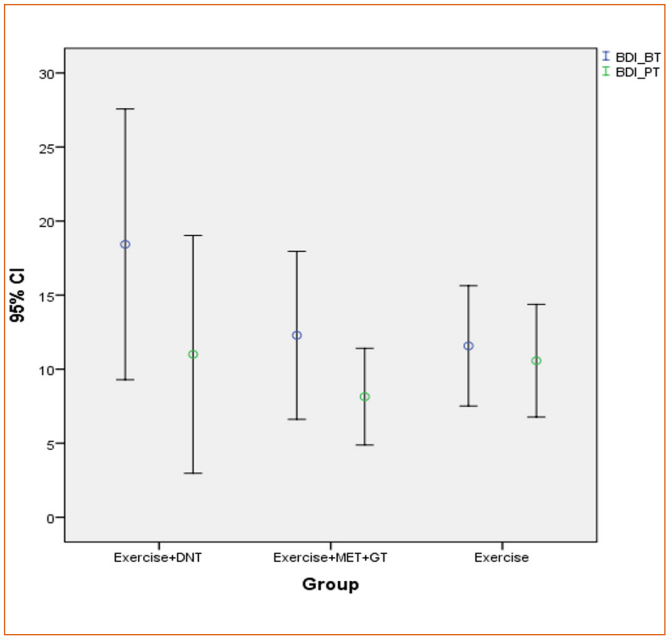

Figure 2. Exercise+Dry Needling, Exercise+Muscle Energy+Graston, and Exercise Effect on BDI (error bar graph with 95% Confidence Interval)
Beck Depression Inventory Before Treatment (BDI_BT)
Beck Depression Inventory Post Treatment (BDI_PT)

According to the results of the ANOVA analysis in repeated measurements, the interaction effect between the groups was found to be significant for the BDI variable on a time basis ($p<0.05$). In other words, the change in BDI values over time differs according to treatment methods (Table 5).

Table 5. Average Beck Depression Inventory Values Before and After Treatment

Group	Before Treatment Average±Standard Deviation	After Treatment Average±Standard Deviation	p
Exercise+DNT (n=7)	18.4±9.9	11±8.7	<0.05
Exercise+DNT+GT (n=7)	12.3±6.1	8.1±3.5	
Exercise (n=7)	11.6±4.4	10.6±4.1	

It was determined that there was a curative effect before and after the treatment in the exercise+DNT applied treatment group evaluated with BDI values and in the exercise+MET+GT treatment group.

The difference between before and after treatment in these groups is statistically significant ($p<0.05$). According to the pairwise comparison analysis, improvement was determined after the treatment in the exercise+DNT applied group and the exercise+MET+GT group compared with the pre-treatment. It is observed that the greatest improvement in BDI values was in the group treated with exercise and DNT (Table 6).

Table 6. Paired Comparisons of Beck Depression Inventory Values Before and Post-Treatment According to Treatment Groups

Group			Average Difference	Standard Error	p	Confidence Interval	
						Lower Limit	Upper Limit
Exercise +DNT	BT	PT	7.4	1.630	0.00	4.0	10.9
	PT	BT	-7.4	1.630	0.00	-10.9	-4.0
Exercise +MET+GT	BT	PT	4.1	1.630	0.02	0.7	7.6
	PT	BT	-4.1	1.630	0.02	-7.6	-0.7
Exercise	BT	PT	1.0	1.630	0.55	-2.4	4.4
	PT	BT	1.0	1.630	0.55	-4.4	2.4

DISCUSSION

In our study, we aimed to compare the effects of invasive and non-invasive treatments. Our results showed that DNT, MET and GT applications were more effective than exercise application.

In MPS, pain is sometimes reflected in areas that are trigger points, usually in areas far from trigger points. It can cause motor dysfunction, fatigue and autonomic disorders.[1,3]

It is one of the most common causes of pain encountered in the clinic. It is among the most common diseases among the musculoskeletal system disorders involving the neckand waist region.[19] Treatment in MPS is usually directed towards pain management and MTP. Inactivation of trigger points and loosening of taut bands is the first step in coping with pain.[2] Many treatment approaches, including invasive and non-invasive, are used in the treatment of MPS.[20] Among the invasive methods, dry needling, acupuncture, steroid, local anesthetic, botulinum toxin and prp injections; pharmacological drug therapy, physical therapy agents, exercise applications, postural and ergonomic supports, kinesiology taping and manual therapy techniques are preferred among noninvasive methods. There are many studies on these methods in the literature.[21-25] Exercise is a frequently preferred method in the treatment of MPS.In MPS, especially light stretching and posture exercises are preferred to resistance strengthening exercises. Because, in the presence of an active trigger point, mechanical stress on the muscle may increase symptoms.[21] Although there are many different studies showing the efficacy of DNT in MPS, recent systematic reviews have low and moderate levels of evidence. There is a need for more randomized controlled studies with specific evaluations for MTPs.[26,27] MET is an effective method for the treatment of chronic and acute neck pain. Used to reduce pain, increase flexibility and range of motion.[28] MET has been found to be effective in comparative studies on MTPs in the upper trapezius muscle.It produces muscle relaxation with postisometric relaxation and respiratory inhibition. Since it works with a mild active contraction during the application, it reduces the pain and allows the stretched band to relax.[29-31.] The number of studies in the literature on GT has been increasing in recent years. There are studies showing its effectiveness on pain, muscle strength and range of motion.[32,33] Studies comparing DNT with MET and GT and studies combining DNT with other applications have been published.[27,30,34] A combination of MET in practice has been recommended in some systematic reviews.[28] In recent years, GT and MET have been used together in clinical applications. There is no study in the literature comparing the combination of DNT with GT and MET. Many different imaging methods are used in the evaluation of MTP.[1,6-11] Although subjective evaluation methods were mostly preferred in comparative studies of DNT with different treatment approaches in the literature, objective studies evaluating its direct effectiveness were also conducted.[12,35,36] In our study, we preferred specific needle EMG evaluation over MTP.[10,37] We planned to compare DNT with the combination of MET and GT. We found that both DNT and GT and MET combination groups were effective on MTP EMG activation and depression symptoms compared to the control group. We think that studies with a larger sample size will be more effective in demonstrating the superiority between groups.

CONCLUSION

In the treatment of MPS, DNT, GT and MET showed a healing effect in upper trapezius muscle active MTPs. Clinicians may not always prefer invasive methods in practice when there are some obstacles such as patient fears. For such reasons, comparative studies are important in terms of creating an alternative. This study may play a role in clinicians' choice of invasive and non-invasive treatment modalities in patient management.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Ankara Medicana International Hospital Ethics Committee (Date: 29.03.2021, Decision No: 12).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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